

Slope Erosion Prevention Techniques

A variety of techniques have been applied along Caltrans highways for erosion prevention on adjacent slopes. This bulletin discusses several of the techniques observed by the Post Construction Inspection Team, notes what is working and what has been less successful, and identifies factors beyond the control of erosion management that can affect side slope stability.

The Issue

Side slopes are often either modified (cut) or created (filled) during the course of construction of a roadway. Immediately following clearing and grubbing and earthmoving activities, the side slopes may be entirely devoid of vegetation and highly susceptible to erosion.



Erosion damage due to untreated slope

Left unchecked, erosion can increase project maintenance requirements, damage project aesthetics, jeopardize the structural integrity of project features, and pose a potential threat to water quality. Erosion control measures, incorporated into the project design or applied as a temporary BMP, minimize the opportunity for erosion impacts to develop.

Erosion Control Techniques

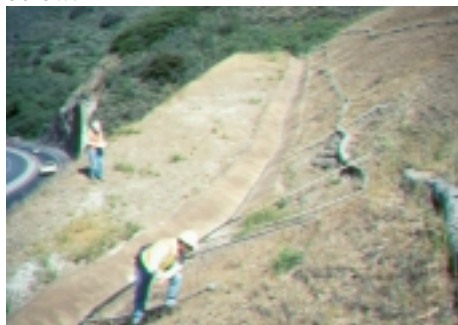
A variety of techniques may be utilized to assist in stabilization of roadside slopes, including both structural and surficial treatments. Major structural efforts require assessment and incorporation during the design phase. These types of efforts include the use of vertical retaining walls, mid-slope horizontal drains and ditches, or slope grade controls. These structural measures have a significant impact on project cost, and are commonly applied

where the roadway design requires a significant cut into an existing hillside and slope lengths or steepness ($>1:1.5$) are too great to deploy surficial erosion control techniques (see photo below).



Retaining wall for slope cut stabilization and top of wall ditch for runoff control

Surficial techniques for erosion control may be used where design slopes are short and sufficiently mild (1:2 or flatter). Surficial techniques include the use of erosion mats or blankets, mulch, silt fences or soil adhesives. Even where structural measures, terrace grading and lined channels have been employed, slope stabilization may require the addition of temporary surficial techniques, such as hydromulch, fiber rolls, concrete ditch and infiltration pipes, as depicted in the photograph below.



Combination of stabilization techniques

Less Successful Treatments

Erosion control measures such as hydroseeding, bonded fiber matrix, rolled plastic sheeting, blankets or geotextiles are not successful in areas where slopes are too steep ($>1:1.5$), or in areas where runoff is not adequately controlled. Surficial techniques cannot be relied upon in areas where flow concentrations or gravitational forces overwhelm the

stabilization effects of the selected product. The Post Construction Inspection Team findings confirm that surficial solutions to roadside erosion problems are only successful when attention has been given to treatment of the underlying grade and control of stormwater runoff.



Soil blanket on a steep hillside with uncontrolled runoff

Other Factors

Additional factors can cause hillside soil loss despite the most conscientious application of structural and surficial erosion control measures. General slope failure, due to geotechnical rather than surficial instabilities, can cause "slip failure" of an entire hillside. Unstable soils, improper grading or off-site construction activities could be factors associated with this type of slope failure. In addition, livestock free to wander on properties abutting project right-of-way can seriously impact the effectiveness of vegetative or onsite measures.



Livestock disruption of hillside stability

Thus, erosion control along constructed or modified roadside slopes is one of several factors that must be given serious consideration in the establishment of stable hillsides associated with Caltrans projects.